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Applicant(s): Reidar SCHUMANN-OLSEN et al.) Group Art Unit: not assigned
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Serial No.:) Examiner: not assigned
)
Filed:)

For: MANAGED HDSL REPEATER

Assistant Commissioner
for Patents
Washington, D.C. 20231

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Type or Print Name Carla Elkins

Signature

Dear Sir:

CLAIM OF PRIORITY UNDER 35 U.S.C. § 119

Under the provisions of 35 U.S.C. 119 Applicant hereby claims the priority of patent application no. NO 20005754 filed on November 14, 2000 , which is mentioned in the declaration of the above-identified application. A certified copy of the priority document is filed herewith.

Respectfully submitted,

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Certification of patent application no

2000 5754

Det bekreftes herved at vedheftede dokument er nøyaktig utskrift/kopi av ovennevnte søknad, som opprinnelig inngitt 2000.11.14

It is hereby certified that the annexed document is a true copy of the above-mentioned application, as originally filed on 2000.11.14

2001.09.14

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Seksjonsleder

Line Reum

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14. november 2000

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Tittel:
Styrt HDSL-repeterer

Managed HDSL repeater

Field of the invention

The present invention is related to Copper line data transmission with HDSL.

Background of the invention

Transmission with HDSL on copper pairs in the local loop is limited in range by cross talk between pairs in the same cable. To cover the range between telecom operators access points and subscriber locations, the use of transmission regenerators are necessary.

For maintenance and error detection and recovery, fault isolation on such systems must be achievable. A way of obtaining this is to provide the regenerators with a facility of looping the signal back to the access points. The regenerators are not easily accessible (dug into the ground), and thus a remote controlling of this looping is needed.

For HDSL (High speed Digital Subscriber Line) transmission systems, a regenerator management is defined as part of the transmission overhead (EOC) channel between the two endpoints of the line, NT and LT respectively. (References; TS 101135 section 5.7.5 from ETSI and G.991.1 section B5.7.1. from ITU.) The standards define the same set of functions for the regenerator as for the endpoints. Fig. 1 shows the HDSL access line.

In practical systems, the endpoint functionality is expensive, and a limited functionality is very often preferred. The use of the overhead channel for regenerator maintenance also requires that this channel is terminated and regenerated, and this introduces transmission delay and implementation complexity. A regenerator is powered via the

transmission lines, and reduction of power consumption, which can be achieved by lower complexity, will extend the distance for remote powering. A pure transmission repeater without overhead channel processing should be a more optimum solution, but it requires another solution of maintenance loop setting.

Summary of the invention

It is an object of the present invention to provide an arrangement that eliminates the drawbacks described above. The features defined in the claims enclosed characterize this method.

More specifically, the present invention is related to a regenerator solution by the use of signal repeaters instead of a regenerator as described in the references, and a solution for remote control of switching a transmission loop ON and OFF.

Compared to the known way of HDSL, regenerator management according to the present invention enables the use of signal repeaters which still have the required practical functionality for management.

Brief description of the drawings

In order to make the invention more readily understandable, the discussion that follows will refer to the accompanying drawings.

Fig. 1 shows a block diagram of an HDSL transmission system.

Fig. 2 shows a block diagram illustrating the activation/deactivation process for an HDSL line.

Fig. 3 shows a block diagram of an HDSL transmission system with the solution of the present invention implemented.

Detailed description

When starting up an HDSL transmission system like the one in fig. 1, there is an activation sequence where transmission parameters are exchanged between the two endpoints of a transmission line. An HDSL transmission line activation/deactivation is shown in Fig. 2. The LT (Line terminal) is located e.g. at the central office and the NT (network terminal) is located on the customer premises.

When a regenerator between LT and NT is at present, the activation/deactivation is between the LT and REG and between the REG and NT. After successful parameter exchange, the transmission is defined to be active and data can be transferred between the endpoints. From active state, the transmission can be deactivated. This activation/deactivation process can be detected in the repeater and used to alternate the repeater to send data transparent between the LT and NT or do a loop back of transmitted data back to the LT.

According to the present invention, this alternation can be made in such a way that every time there is a deactivation/activation command from LT, a flip-flop in the repeater is being toggled. Flip-flop high can be interpreted as loop while flip-flop low is interpreted as transparency. The overhead channel is passing through the repeater between the endpoints LT-NT untouched.

The present invention makes use of one of the free bits in the overhead channel as an origin bit which is set to "1" in the upstream direction and "0" in the downstream direction, for thereby making it possible to detect at the access point (LT) whether there is a loop in the repeater or not by looking at the received origin bit. Origin bit

"0" indicates loop while origin bit "1" indicates data transparency.

As the complete overhead channel is looped back, it is also possible to check the transmission quality by looking at the standardised HDSL error, monitoring in the same way as with a normal end-to-end connection.

The main advantage of the present invention is that it allows using passive repeaters for regeneration on the transmission line in an HDSL system, and still having the possibility for remote maintenance and management.

Another advantage is that passive repeaters are much less power consuming than conventional regenerators, and are also less complex and smaller.

Still another advantage of the present invention is that no data processing needs to be carried out in the repeater. All signals are simply amplified and passed through the repeater. Therefore, the delay introduced in the repeater is limited to a minimum. Also, the fact that the repeater does not need to have any significant software installed, contributes to minimizing the likelihood of errors, and the probable lifetime will increase.

Patent claims

1. An arrangement in a communication system comprising a line terminal (LT), a network terminal (NT) and a repeater means (R), said LT connected to said R by a first transmission line, and said R further connected to said NT by a second transmission line, transmission between LT and NT is activated and deactivated with a certain activation/deactivation process,
c h a r a c t e r i z e d i n that said repeater means is adapted to detect said activation/deactivation process and to alternate a flip-flop included in said repeater means between a first state and a second state on response to a detected activation/deactivation process, said transmission is passed through said repeater means when said flip-flop is in said first state, and is looped back in said repeater means when said flip-flop is being in said second state.

2. An arrangement as defined in claim 1,
c h a r a c t e r i z e d i n that a free bit in an overhead channel of the transmission is being set to a first level when transmitting in the LT-NT direction, and a second level when transmitting in the NT-LT direction.

3. An arrangement as defined in claim 1 or 2,
c h a r a c t e r i z e d i n that said repeating means is a signal repeater.

4. An arrangement as defined in any of the preceding claims,
c h a r a c t e r i z e d i n that said communication system is an HDSL (High speed Digital Subscriber Line) communication system and that said activation/deactivation process is an activation/deactivation process used in said HDSL communication system.

5. An arrangement as defined in claim 2-4, c h a r a c t e r i z e d i n that said first level is "1", and said second level is "0".

6. Use of an arrangement as defined in claim 2-5 in standardized HDSL error monitoring at the LT when said transmission is looped back in said repeating means indicated by said free bit being set to said first level.

Abstract

A repeater for HDSL transmission is presented. The repeater replaces the regenerator commonly used in HDSL by utilizing the activation/deactivation process in the HDSL specification. The repeater is adjusted to detect an activation/deactivation sequence, whereby a flip-flop in the repeater is alternated. A first state of the flip-flop allows transmission passing through the repeater to the terminating point, e.g. a network terminal (NT), and a second state loops transmission back to the originating point, e.g. a line terminal (LT). The looping may then be utilized for maintenance and error detection and recovery. By use of one of the free bit in the overhead channel in the HDSL transmission as an origin bit, wherein "1" is set in the upstream direction (NT-LT), and "0" is set in the downstream direction, it is possible to detect at the LT whether there is a loop in the repeater.

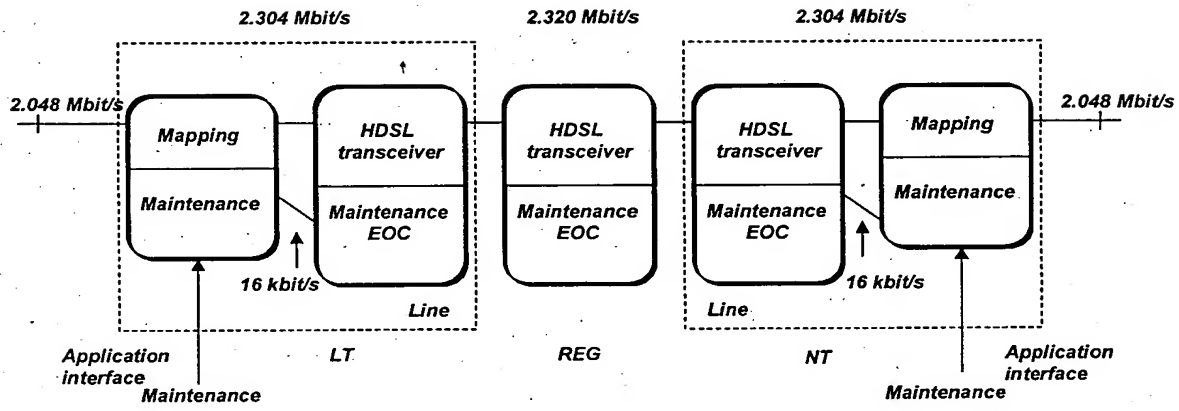

Fig. 1 HDSL transmission system

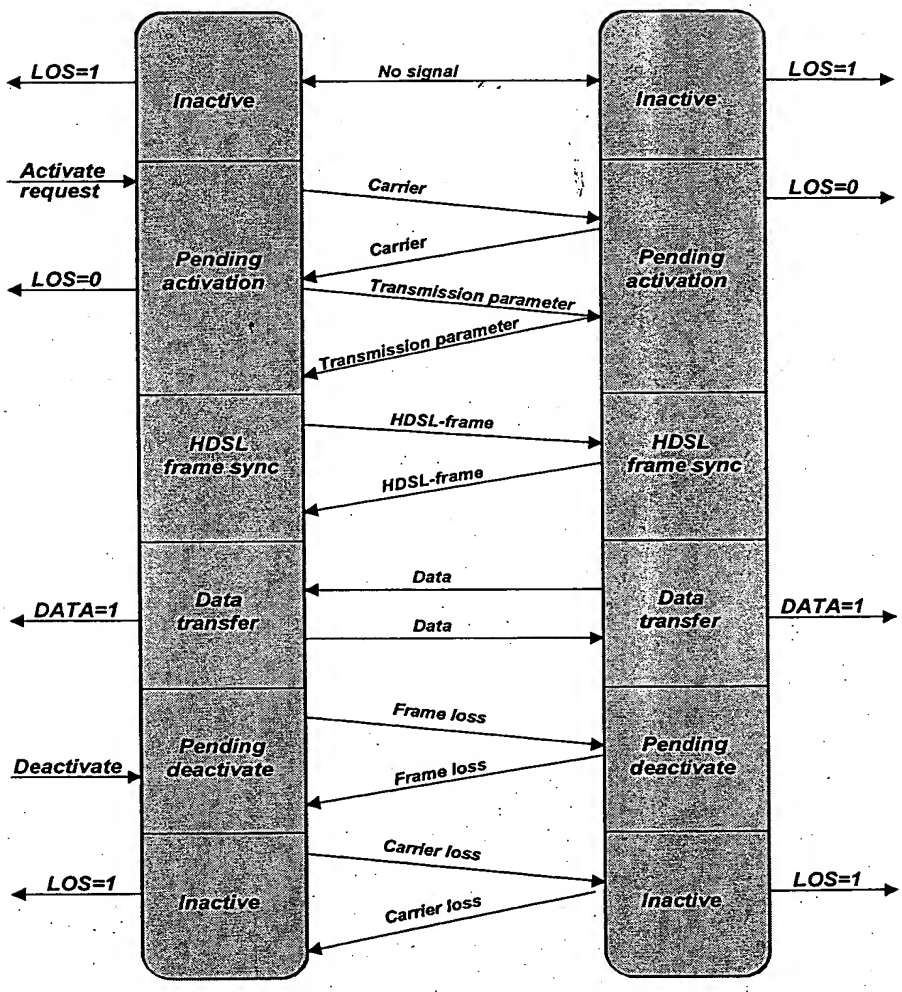

Fig. 2
Activation/deactivation of HDSL-linesystem

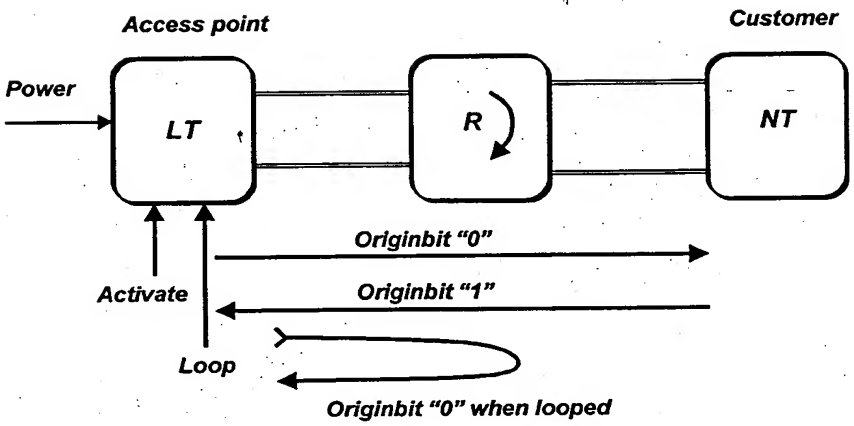

Fig. 3